# A FIRE DOOR AND A FIRE PROTECTION SYSTEM

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FR2700186
EP0798441

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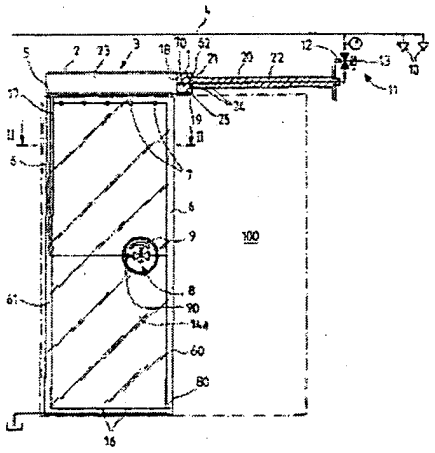
Abstract of **WO0169028**

The invention relates to a hydraulic fire door, especially a sliding door, which can be selectively opened or closed, and the fire door being provided with an actuator (3) for moving said door from an opened position to a closed position. In order to ensure a particularly fire resistant fire door without the heat resistance of the basic structure thereof having to be particularly good, the actuator (3) is arranged to supply aqueous liquid to the fire door in order to cool it using the aqueous liquid. The invention also relates to a fire protection system.



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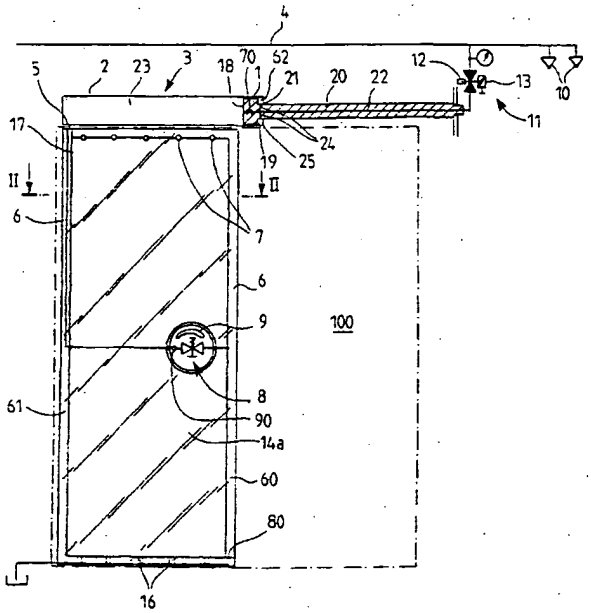
(54) Title: A FIRE DOOR AND A FIRE PROTECTION SYSTEM




(57) Abstract: The invention relates to a hydraulic fire door, especially a sliding door, which can be selectively opened or closed, and the fire door being provided with an actuator (3) for moving said door from an opened position to a closed position. In order to ensure a particularly fire resistant fire door without the heat resistance of the basic structure thereof having to be particularly good, the actuator (3) is arranged to supply aqueous liquid to the fire door in order to cool it using the aqueous liquid. The invention also relates to a fire protection system.

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# A FIRE DOOR AND A FIRE PROTECTION SYSTEM

## BACKGROUND OF THE INVENTION

**[0001]** The invention relates to a hydraulic fire door, especially a sliding door, which can be selectively opened or closed, the fire door being provided with an actuator for moving the door from an opened position to a closed position.

**[0002]** Hydraulic fire doors are known. They are generally, i.e. not in the event of fire, used together with door openings, which are kept open. When fire occurs or when flue gases are created, the fire doors are closed in order to prevent the fire or flue gases from spreading.

**[0003]** If a fire door needs to be highly resistant in high temperatures, the door is correspondingly dimensioned and made of a material or materials that endure high temperatures. Therefore the fire door surfaces are typically made of steel. Steel fire doors do not allow to monitor the fire and/or flue gases through the door. The people possibly behind the closed steel doors cannot either be seen. Transparency would, however, help to evaluate how far the fire and flue gases have spread, and also to observe the people, which naturally is of advantage in the event of fire. The massive weight of steel makes the steel doors heavy. Where applied, for example on ships, the massive weight of the fire doors is a significant drawback. Known fire doors are provided with hydraulic pipe system and control systems that render the hydraulic fire doors fairly expensive.

**[0004]** The invention also relates to a fire protection system comprising a fire extinguishing system and a hydraulic fire door, more particularly to a sliding door, which can be selectively opened or closed, the fire door being provided with an actuator for moving the door from an opened position to a closed position. The fire protection system typically comprises several spray heads and fire doors. These fire doors are also associated with the problems described above.

**[0005]** The fire doors including hydraulic systems are notably constructed as systems separate from fire extinguishing systems, so that a piston cylinder unit in the fire doors comprising feeding pipes and a control system are placed apart in a pipe system and a control system of the fire protection system, consequently rendering the fire protection system very expensive.

BRIEF DESCRIPTION OF THE INVENTION

**[0006]** It is an object of the invention to provide a hydraulic fire door having an improved fire resistance and irrespective thereof the fire door can if desired be made of a material whose fire resistance is not particularly good.

**[0007]** This is achieved with a fire door of the invention characterized in that the actuator is arranged to supply aqueous liquid to the fire door in order to cool it using the aqueous liquid. The liquid to be employed in the actuator is used to close the door. A facing surface of the door is preferably cooled; the term facing surface referring in this context to any large door surface. The facing surface may be an outer surface or an inner surface.

**[0008]** The preferred embodiments of the fire door of the invention are disclosed in the appended claims 2 to 23.

**[0009]** The most significant advantages of the fire door of the invention are that the fire resistance thereof is very good without the heat resistance of the basic structure thereof, i.e. the frame or face surfaces of the door, having to be particularly good, in which case the fire door may, for example, be transparent and made of glass, and that an actuator, such as a piston cylinder unit, is utilized for improving the fire resistance thereof in order to cool the door, whereby the fire door and the apparatus cooling the door are formed of a compact unit.

**[0010]** The fire protection system of the invention is characterized in that the actuator is arranged to supply aqueous liquid to the fire door in order to cool it using the aqueous liquid.

**[0011]** Most preferably the actuator is connected with a line in the fire extinguishing system for supplying said liquid through an output starting from the actuator and a feeding channel to the upper part of the fire door and from there further to the facing surface of the fire door. Thus the large surfaces of the doors can from the beginning be evenly cooled, as the cooling is most efficient there where the temperature most likely is the highest in the event of fire.

**[0012]** The line is preferably the one leading to the spray heads of a fire extinguishing or fire fighting system, since the lines intended for the spray heads are then utilized as well as the pressures therein when closing and cooling the door, and the door hydraulics is not different from the fire extinguishing hydraulics. This allows great cost savings to be made.

**[0013]** The actuator is preferably a piston cylinder unit comprising a piston and a cylinder, since the structure of such a unit is simple.

**[0014]** The most significant advantage of the fire protection system according to the invention is that in addition to the fire extinguishing system it comprises a fire door, whose fire resistance is very good without the heat resistance of the basic structure thereof, i.e. the frame or facing surfaces of the door, having to be particularly good, in which case the fire door may, for example, be made of glass, or be transparent, and that the actuator is utilized for improving the fire resistance of the fire door (for cooling the door), the fire door and the apparatus cooling the door thus forming a compact unit. As the actuator is also connected to a line leading to the spray heads in the fire extinguishing system, great cost savings are made, since the lines in the fire protection system are greatly reduced as well as the need for control.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0015]** In the following the invention will be described in greater detail by means of the preferred embodiments with reference to the accompanying drawing, in which

**[0016]** Figure 1 shows a first embodiment of a fire door in an opened position,

**[0017]** Figure 2 shows a view along the cutting line II – II of Figure 1,

**[0018]** Figure 3 shows the fire door of Figure 1 in a closed position,

**[0019]** Figure 4 shows a second embodiment of the fire door in an opened position,

**[0020]** Figure 5 shows a view along the cutting line V – V of Figure 4, and

**[0021]** Figure 6 shows the fire door of Figure 4 in a closed position.

## DETAILED DESCRIPTION OF THE INVENTION

**[0022]** Figure 1 shows a fire door of the invention made of glass, and in an opened position, or in a standard using position. Reference numeral 100 illustrates a door opening. In the event of fire and/or when an attempt is made to prevent the access of flue gases through the door opening 100, said door opening is closed by means of the fire door.

**[0023]** The fire door is a sliding door. A piston cylinder unit 3 placed above the door enables the door to slide into the position shown in Figure 3, in which the door covers the door opening.

**[0024]** The piston cylinder unit 3 is connected using a throttle valve 11 to a line 4 that leads to spray heads 10. The throttle valve 11 is generally closed.

**[0025]** The throttle valve 11 comprises a thermal trigger means 12 and a solenoid 13. The solenoid 13 is arranged to open the throttle valve 11 after obtaining a signal from the detector (not shown). The thermal trigger means may, for example, be a glass ampoule 12, which is arranged to open the throttle valve 11 after having exploded at a high temperature. The throttle valve 11 may also, or alternatively, be used mechanically.

**[0026]** The piston cylinder unit 3 comprises a cylinder 2 and a piston 1 arranged therein. Reference numeral 18 indicates a free end of the piston and reference numeral 19 another end of the piston, to which a piston rod 20 is attached. An opening 21 in a cylinder end 62 surrounds the piston rod 20 so that a liquid tight wall of the opening surrounds the piston rod. The piston rod 20 comprises a through passage 22 that continues through a throttling 70 to the free end 18 of the piston. The passage 22 provides a start for channels 24 leading to a space 25 defined by the piston end 19, the piston rod 20 and the end 62 at the cylinder 2 opening 21. The channel passing through the piston, the throttling 70 and the channels 24 are dimensioned such that the pressure created on the channel 22 (the pressure is formed when the throttle valve 11 opens) causes a higher pressure to the space 25 than to a space 23 defined by the cylinder 2 and the free end 19 of the piston. The flow resistance on the channels 24 is lower than the flow resistance through the piston 1 owing to the throttling 70. The structure may comprise only one channel instead of several channels.

**[0027]** The cylinder 2 includes an output 5 that leads to a feeding channel 6. The feeding channel 6 travels downwards from the output, first formed as a pipe, along a passage 61 on the vertical edge of the door. At a central or middle part of the door the pipe 6 continues horizontally past an actuating means 9 intended to open the door and through an opening valve 8 of the door to the opposite edge of the door, where the feeding channel is formed of a relatively narrow vertical passage 60. A door frame forms the passage 60. The passage 60 is restricted at the bottom against a stop 80 and continues

upwards to the corner of the door and from there horizontally as a passage moving along the upper edge of the door with several spray openings 7 at the bottom thereof arranged substantially at the entire width of the door.

**[0028]** The opening valve 8 is generally open. The opening valve 8 is closed only in such a case, when the closed door is to be opened, cf. Figure 3. The pipe 6 includes a check valve 90. The opening valve 8 can be closed using a handle 9 in the opening valve 8. The operation is mechanical and/or electric.

**[0029]** Figure 2 shows that the door comprises two spaced glass surfaces 14a and 14b, forming a so called double glazing, between which a space 15 is formed.

**[0030]** In the following the operation of the fire protection system in Figures 1 to 3 is explained.

**[0031]** When fire breaks out, the detector (not shown) that can be any detector reacting to fire, such as a smoke detector, provides a signal to the solenoid 13 of the throttle valve that opens the throttle valve 11. Alternatively an ampoule 12 attached to the throttle valve 11 opens the throttle valve after having exploded owing to the heat; thus providing an alternate means for opening the throttle valve. The compressed water in the line 4 moves through the throttle valve 11 to the piston cylinder unit 3 so that a higher pressure is formed to the space 25 than to the space 23. On account of the above the cylinder 2 moves in relation to the piston 1 and draws the door with it, as the door is fastened to the cylinder. When the cylinder 2 moves from the position shown in Figure 1 to the right ending up in the position shown in Figure 3, water flows to the space 23. Water flows through the output 5 to the pipe 6 and through the opening valve 8 to the passage 60 that is filled from the bottom to the top. The passage 60 rapidly fills up as the volume thereof is fairly small, manifoldly smaller than the volume of the space 15 between the glass surfaces 14a, 14b. The flowing water reaches the upper edge of the door and water starts to spray through the spray openings 7 onto the glass surfaces 14a, 14b cooling them evenly at least in the width direction of the door. The spray openings 7 are arranged to cool at first the upper part of the door, where the fire causes the highest heat stress to the door. A lower edge of the door comprises liquid outlet ports 16. The flow through the liquid outlet ports 16 is smaller than the flow from the spray openings 7. Therefore the space 15 is filled with water. The liquid outlet ports 16 provide the space 15 with an effi-

cient, cooling water circulation. The liquid outlet ports 16 are naturally also intended to remove the water collected into the space 15 when the fire door is no longer subjected to an actual heat load. An overflow opening 17 is formed at the upper edge of the door that prevents an excess liquid pressure to be formed in the space 15. The water heated in the fire can also be removed through the overflow opening 17 from the upper part of the space 15 where the fire heats the water the most. The water flows along the passage 61 through the overflow opening 17 to the outlet port in the lower part of the door, and new cold and cooling water is constantly sprayed into the space 15 from the spray openings 7.

**[0032]** If the closed door in the position shown in Figure 3 is to be opened, then a handle 9 is pulled and the opening valve 8 is shut and water can no longer flow inside the door and the door is opened. The door is opened since the pressure is normalized on both sides of the piston 1 of the piston cylinder unit 3, i.e. in the spaces 23 and 25. In the space 23, the surface of the piston's free end 18 that the pressure affects is greater than the surface of the piston end 19 that in the space 25 points towards the piston rod. When the door is closed, liquid flows out from the space 25.

**[0033]** Figures 4 to 6 illustrate another embodiment of the invention. The same reference numerals are used in Figures 4 to 6 as in Figures 1 to 3 for corresponding parts.

**[0034]** The embodiment in Figures 4 to 6 deviates from the one shown in Figures 1 to 3 in that the ampoule 120' and solenoid 130' are arranged close to the opening valve 8'. The throttle valve is merely a mechanical closing valve 11' without an ampoule or a solenoid. The throttle valve 11' is generally open and the spray heads 10' are then typically sprinklers comprising ampoules reacting to heat.

**[0035]** The detector (not shown), which may be any detector reacting to fire, such as a smoke detector, provides through an electric wire 63' the solenoid 130' that opens the opening valve 8' with a signal in the event of fire. Then, as the door is opened and is in the position shown in Figure 4, the cylinder 2' moves to the right and the door moves towards the position in Figure 6. Alternatively the ampoule 120' connected to the opening valve 8' opens the opening valve, after been broken in the heat created by the fire. It is further possible that the ampoule 120' can also, or alternatively, be broken by heating using electric current. When the opening valve 8' is opened, water flows into

the space 23' that is transferred via the output 5' and the pipe 6' through the opening valve to the passage 60'. When the passage 60' is filled with water, which occurs rapidly, the water starts to spray into the space 15' from the spray openings 7' and to flow away through outlets 16'.

**[0036]** If the fire door is to be opened from the position shown in Figure 6, the opening valve 8' is closed, for example, by providing it with an electric impulse through the handle 9', in which case a mechanical electric opening is concerned. Alternatively the electric impulse can be achieved without the handle 9 or another mechanical device using a detector. The door is opened when the opening valve 8' is closed, and the liquid flows away from the space 25'.

**[0037]** The invention is described above by means of two examples and it is therefore pointed out that the details of the invention can be implemented in different ways deviating from the examples within the scope of the appended claims. Therefore, the door may for example include a single glass instead of double glazing 14a, 14b, 14a', 14b' or may include multi glazing. In a single glass door, the spray means 7, 7' are arranged to spray to either of the two outer surfaces of the glass or to both outer surfaces. The door does not necessarily have to be a glass door, although this is to be recommended. Instead of a piston cylinder unit another hydraulic actuator can be used that allows the door to be opened and closed and vice versa. However, the piston cylinder unit is an easy way to implement the actuator. Instead of a sliding door the fire door may, at least in principle, be e.g. a hinged door, in which case the actuator, typically a piston cylinder unit, is pivoted to the door. However, a sliding door is in many respects a better solution as a fire door than a hinged door. It is possible to initiate the closing of the door and the spraying of the liquid into the door manually without having to start these functions by means of a detector or an ampoule.

CLAIMS

1. A hydraulic fire door, especially a sliding door, which can be selectively opened or closed, the fire door being provided with an actuator (3, 3') for moving the door from an opened position to a closed position, **characterized** in that the actuator (3, 3') is arranged to supply aqueous liquid to the fire door in order to cool it using the aqueous liquid. (Figures 1 to 6)

2. A fire door as claimed in claim 1, **characterized** in that the actuator is arranged to supply aqueous liquid onto a facing surface of the fire door. (Figures 1 to 6)

3. A fire door as claimed in claim 1, **characterized** in that the actuator (3, 3') is arranged to supply said liquid through a feeding channel (6, 6') to the upper part of the fire door. (Figures 1 to 6)

4. A fire door as claimed in claim 3, **characterized** in that the feeding channel (6, 6') comprises a set of spray openings (7, 7') arranged at the upper part of the fire door for supplying said liquid onto the facing surface of the fire door. (Figures 1 to 6)

5. A fire door as claimed in claim 3 or 4, **characterized** in that the feeding channel (6, 6') comprises an opening valve (8, 8') for opening the fire door when it is in the closed position. (Figures 1 to 6)

6. A fire door as claimed in claim 5, **characterized** in that the opening valve (8, 8') is functionally connected to an actuating means (9, 9') arranged for opening the fire door in order to close the opening valve using the actuating means for opening the closed fire door. (Figures 1 to 6)

7. A fire door as claimed in claim 6, **characterized** in that the actuating means is a mechanical device (9) arranged centrally of the door. (Figure 1)

8. A fire door as claimed in claim 6, **characterized** in that the actuating means comprises an at least partly electrical device (9'). (Figure 6)

9. A fire door as claimed in claim 6, **characterized** in that the opening valve (8') comprises a solenoid (130') for opening the opening valve and for closing the fire door from the opened position. (Figure 6)

10.A fire door as claimed in claim 6, **characterized** in that the opening valve (8') comprises a thermal trigger means (120') for opening the opening valve and for closing the opened fire door. (Figure 4)

11. A fire door as claimed in any preceding claim, **characterized** in that the actuator (3, 3') is connected to a line (4, 4') leading to spray heads (10, 10') in a fire extinguishing system. (Figures 1 to 6)

12. A fire door as claimed in claim 11, **characterized** in that a throttle valve (11, 11') is arranged between the line (4, 4') and the actuator (3, 3'). (Figures 1 and 4)

13. A fire door as claimed in claim 12, **characterized** in that the throttle valve (11) comprises a solenoid (13) for closing the throttle valve and for opening the fire door from the closed position. (Figure 1)

14. A fire door as claimed in claim 12, **characterized** in that the throttle valve (11) comprises a thermal trigger means (12) for opening the fire door and for closing the opened fire door. (Figure 1)

15. A fire door as claimed in any preceding claim, **characterized** in that the fire door is made of glass. (Figures 1 to 6).

16. A fire door as claimed in claim 15, **characterized** in that the fire door is a glass door comprising spaced glass surfaces (14a, 14b, 14a', 14b') and in that the feeding channel (6, 6') is arranged to supply said liquid into a space (15, 15') between the glassed surfaces. (Figures 1 to 6)

17. A fire door as claimed in claim 16, **characterized** in that the fire door comprises a passage (60, 60'), whose volume is small compared to the volume of the space (15, 15') between the glass surfaces (14a, 14b, 14a', 14b'), the passage being a part of said feeding channel (6, 6'). (Figures 1 to 6)

18. A fire door as claimed in claim 17, **characterized** in that the passage (60, 60') is formed inside a frame of the door.

19. A fire door as claimed in claim 17, **characterized** in that a lower part of the fire door comprises at least one liquid outlet opening (16, 16'). (Figures 1 to 6)

20. A fire door as claimed in claim 19, **characterized** in that an upper part of the fire door comprises an overflow opening (17) for emptying the liquid into the lower part of the fire door. (Figure 1)

21. A fire door as claimed in any preceding claim, **characterized** in that the actuator is a piston cylinder unit (3, 3') comprising a piston (1, 1') and a cylinder (2, 2').

22. A fire door as claimed in claim 21, **characterized** in that the piston (1, 1') of the piston cylinder unit (3, 3') comprises a free end (18,

18') and an end (19, 19') arranged opposite to the free end, said end (19, 19') being connected to a piston rod (20, 20') that is surrounded by a liquid tight wall of an opening (21, 21') in the cylinder, and in that the piston rod and the piston comprise a through passage (22, 22') for supplying said liquid through the piston rod into a first space (23, 23') between the cylinder (2, 2') and the free end of the piston and in that the piston rod comprises a channel (24, 24') that leads to a second space (25, 25') defined by the piston rod, the piston end (19, 19') pointing towards the piston rod, the cylinder portion surrounding the piston rod and an end (62, 62') at the cylinder opening (21, 21'). (Figures 1 and 4)

23. A fire door as claimed in claim 22, **characterized** in that the flow resistance of the passage (22, 22') leading to the first space (23, 23') through the piston (1, 1') exceeds the flow resistance of the channel (24, 24') leading to the second space (25, 25'). (Figures 1 and 2)

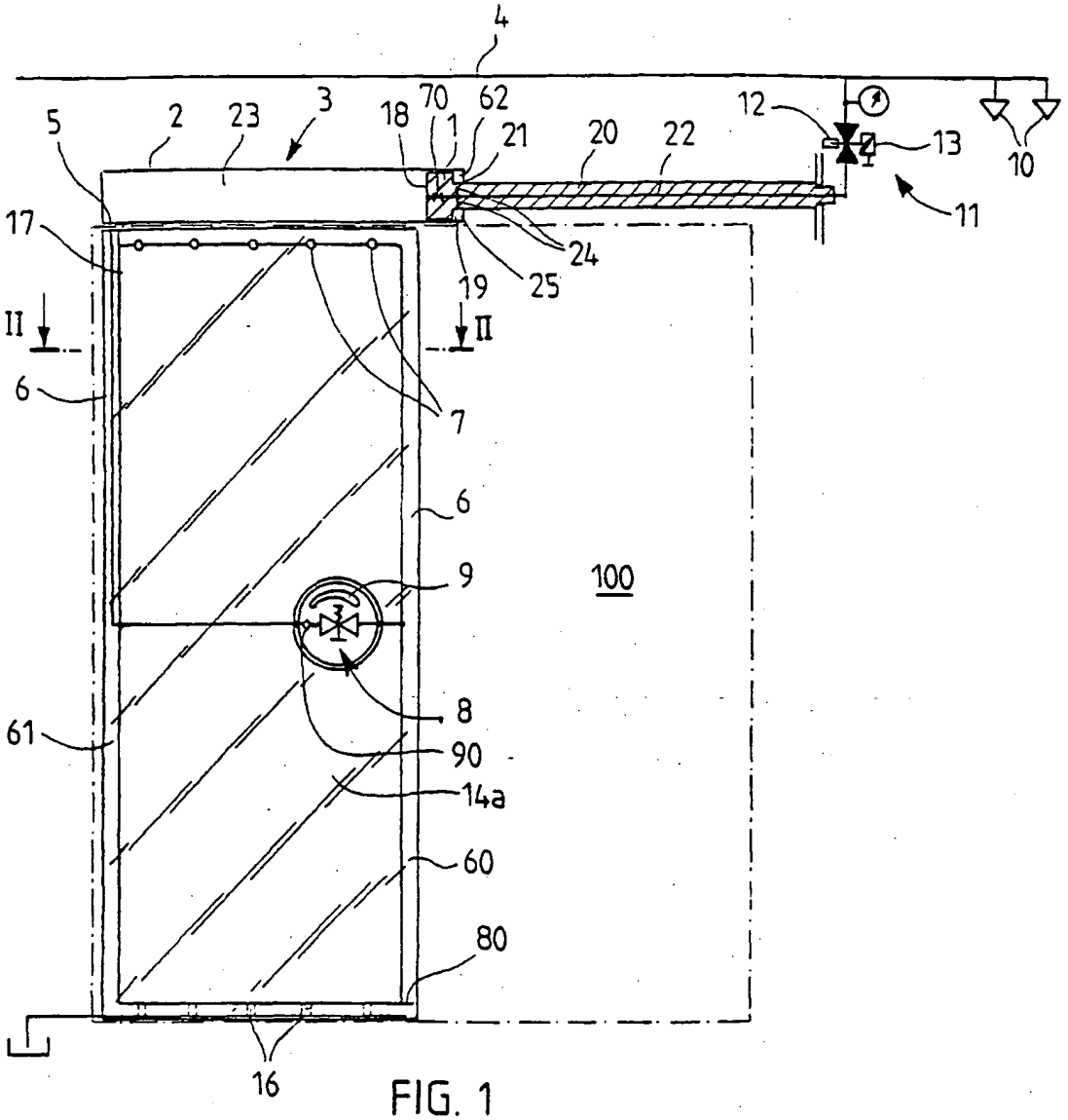
24. A fire protection system comprising a fire extinguishing system and a hydraulic fire door, especially a sliding door, which can be selectively opened or closed, the fire door being provided with an actuator (3, 3') for moving the fire door from an opened position to a closed position, **characterized** in that the actuator (3, 3') is arranged to feed aqueous liquid to the fire door in order to cool it using the aqueous liquid. (Figures 1 to 6)

25. A fire protection system as claimed in claim 24, **characterized** in that the actuator is arranged to supply aqueous liquid onto a facing surface of the fire door. (Figures 1 to 6)

26. A fire protection system as claimed in claim 24 or 25, **characterized** in that the actuator (3, 3') is connected to a line (4, 4') of a fire extinguishing system for feeding said liquid through an output (5, 5') starting from the actuator (3, 3') and a feeding channel (6, 6') to the upper part of the fire door. (Figures 1 to 6)

27. A fire protection system as claimed in claim 26, **characterized** in that the line is a feeding line (4, 4') leading to spray heads (10, 10') in the fire extinguishing system. (Figures 1 to 6)

28. A fire protection system as claimed in claim 25, **characterized** in that the actuator is a piston cylinder unit (3, 3') comprising a piston (1, 1') and a cylinder (2, 2').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14a
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80
16

FIG. 1

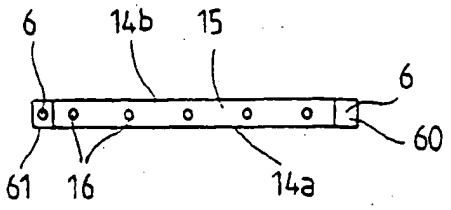
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FIG. 2

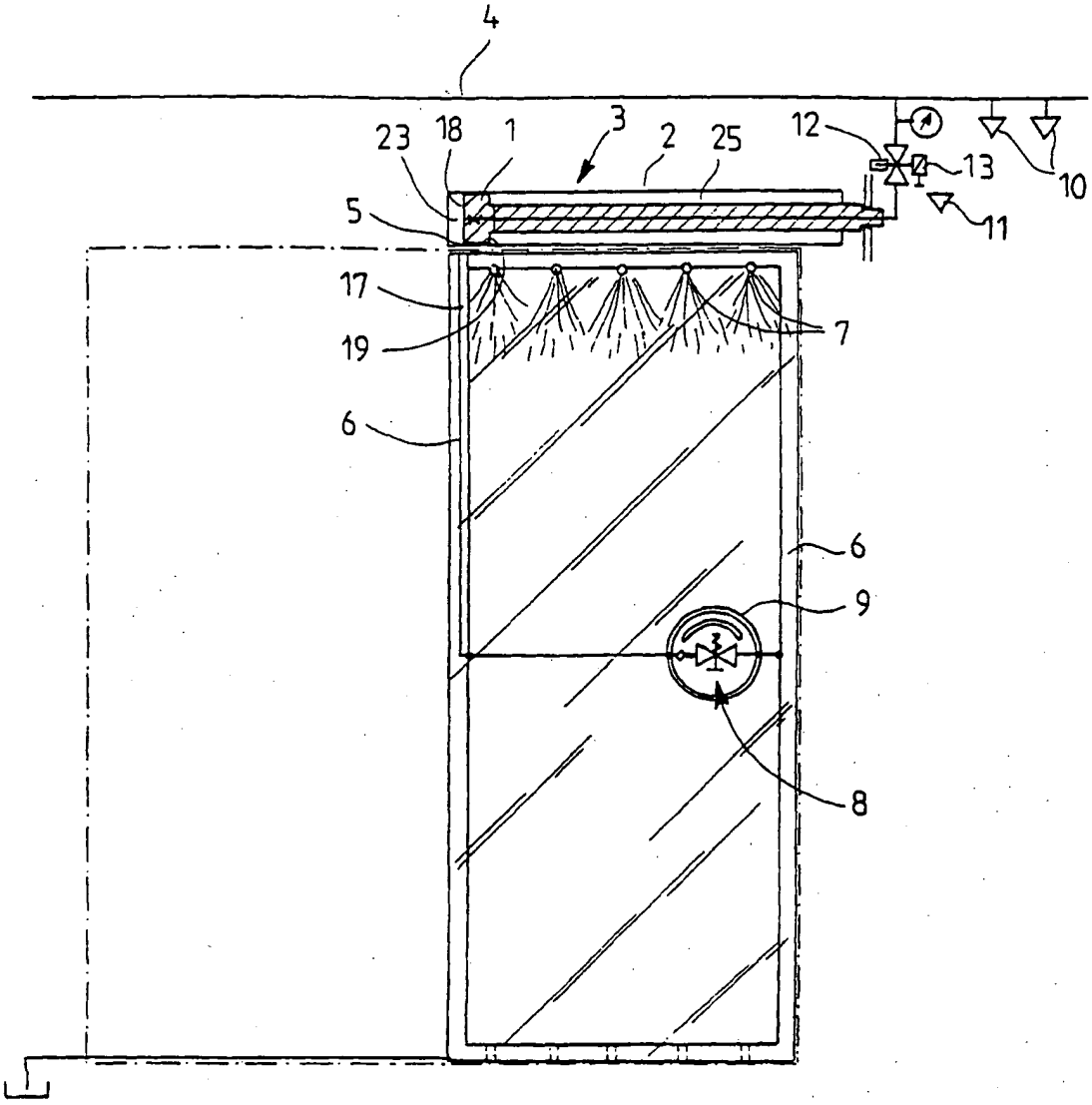


FIG. 3

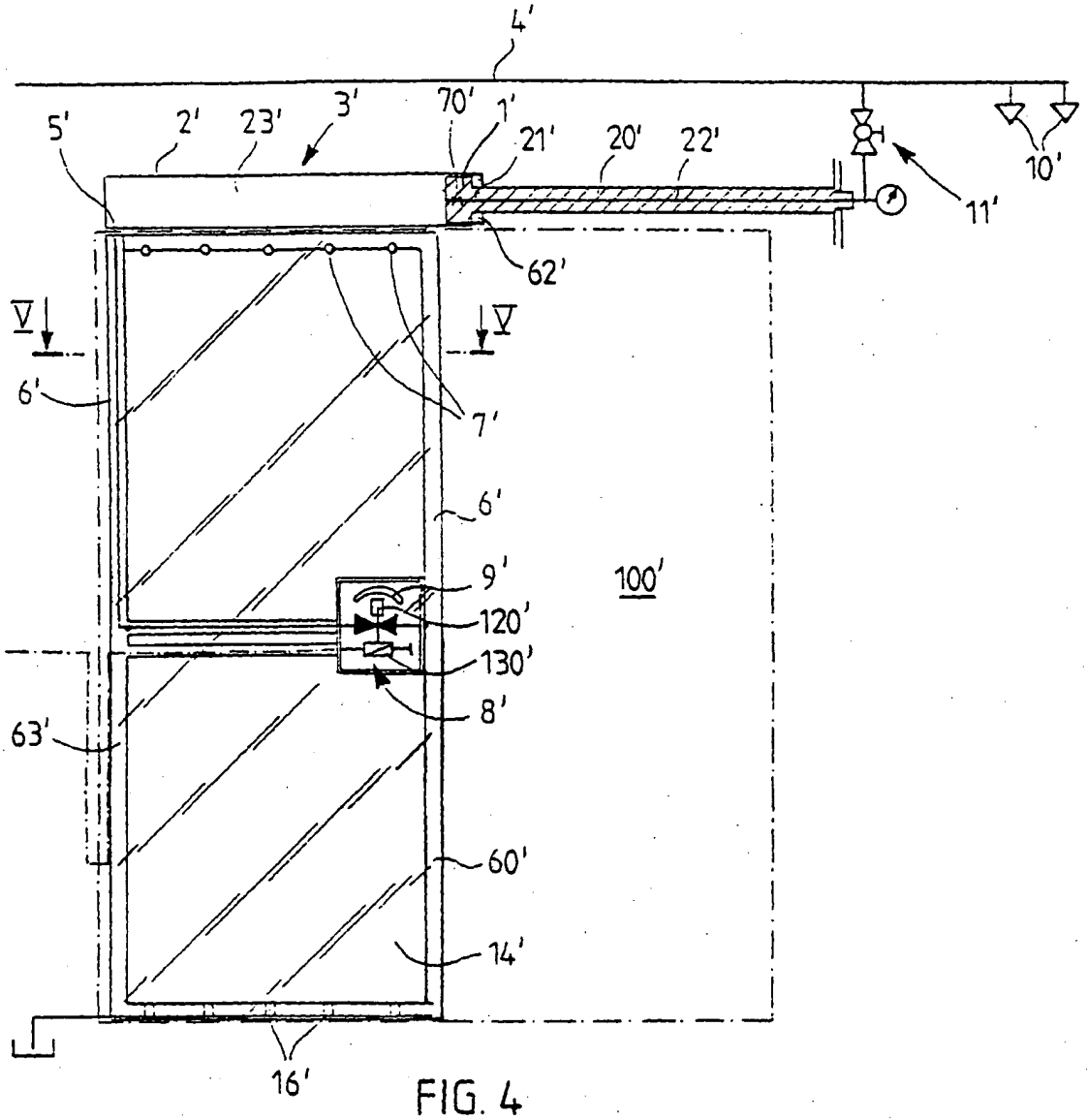
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FIG. 4

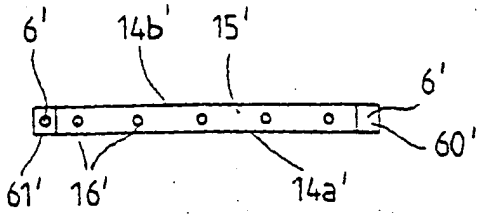
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FIG. 5

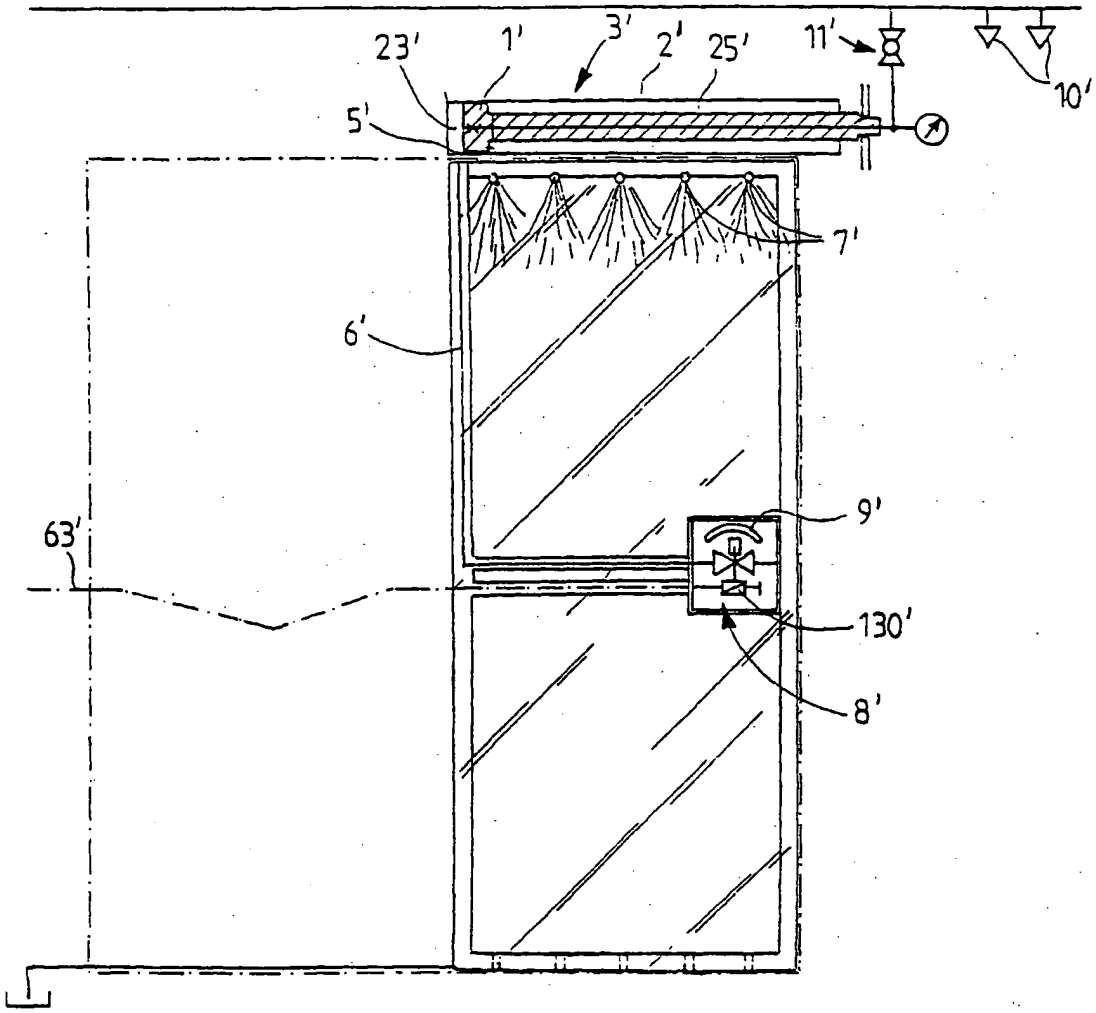


FIG. 6

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/00249

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E06B 5/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | GB 1224385 A (SULZER BROTHERS LIMITED), 10 March 1971 (10.03.71) -- | 1-28 |
| A | FR 2700186 A1 (FICHET BAUCHE ET AL), 8 July 1994 (08.07.94) -- | 1-28 |
| A | EP 0798441 A2 (GEZE GMBH & CO.), 1 October 1997 (01.10.97) -- -------- | 1-28 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 15 June 2001 | 19 -06- 2001 |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br>Ake Olofsson / MRo<br>Telephone No. +46 8 782 25 00 |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

28/05/01

International application No.
PCT/FI 01/00249

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| GB 1224385 A | 10/03/71 | AT 298742 B | 15/04/72 |
| | | AT 304821 B | 15/12/72 |
| | | BE 717514 A | 03/01/69 |
| | | BE 717626 A | 06/01/69 |
| | | BE 717627 A | 06/01/69 |
| | | BE 717628 A | 06/01/69 |
| | | CH 475467 A | 15/07/69 |
| | | CH 475468 A | 15/07/69 |
| | | CH 475469 A | 15/07/69 |
| | | CH 476197 A | 31/07/69 |
| | | DE 1778857 A,B | 20/01/72 |
| | | DE 1778858 B | 25/05/72 |
| | | ES 355736 A | 01/10/70 |
| | | ES 355737 A | 01/07/70 |
| | | FR 1573446 A | 04/07/69 |
| | | FR 1573447 A | 04/07/69 |
| | | FR 1573448 A | 04/07/69 |
| | | FR 1573449 A | 04/07/69 |
| | | GB 1223896 A | 03/03/71 |
| | | GB 1224384 A | 10/03/71 |
| | | GB 1224386 A | 10/03/71 |
| | | NL 6809415 A | 07/01/69 |
| | | NL 6809416 A | 07/01/69 |
| | | NL 6809417 A | 07/01/69 |
| | | NL 6809418 A | 07/01/69 |
| | | NO 123659 B | 27/12/71 |
| | | US 3590913 A | 06/07/71 |
| FR 2700186 A1 | 08/07/94 | EP 0621879 A | 02/11/94 |
| | | NO 307789 B | 29/05/00 |
| | | NO 942627 A | 01/09/94 |
| | | US 5512372 A | 30/04/96 |
| EP 0798441 A2 | 01/10/97 | DE 19607967 A | 04/09/97 |